Electronic Version
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Claims

[c1] An Open Wireless Architecture (OWA) for fourth generation mobile communications said system comprising:

a) A wireless communication terminal device supporting various different wireless standards (air interfaces) in the same device with same unique identifier and capable of communicating with other devices, systems or networks through a wireless medium or over-the-air network,

b) An advanced computer system equipped with full networking facilities to access various different backbone networks through wireline networking interfaces or sometimes through broadband wireless access systems,

c) An advanced transceiver system supporting various different air interfaces to interconnect said wireless communication terminal device, etc through the air link,

d) said transceiver system connected to said computer system to construct the base-station as a whole,

e) said wireless terminal device can also connected to different wireline networks through its networking

interfaces in the said wireless terminal device,

f) said base-station can connected to other base-station either over the wireline networks or over broadband wireless access system through said computer system, or by over-the-air networks through said transceiver system,

g) said wireless terminal device can also connected to other wireless terminal device through the air link in an ad-hoc mode in case of special situations.

[c2] The Open Wireless Architecture (OWA) for fourth generation mobile communications of claim 1 wherein: both said wireless terminal device and said base-station further comprising:

a) An open processing engine to process the signals and protocols of various different air-interfaces (including user-defined air interface) for over-the-air networking and transmission,

b) A reconfigurable digital converter to transform the received signals to the digital base-band signals and vice verse, and connected to said open processing engine,

c) A programmable radio frequency (RF) module and smart antenna processing module of different frequencies to support different air-interfaces, and connected to said digital converter,

d) A software definable module (SDM) containing parameters, algorithms and protocols, etc of some wireless air-interfaces to be stored in an external memory card or downloaded from networks,

e) An open wireless BIOS (basic input/output system) structure capable of providing the common and open interfaces to said processing engine, said digital converter, said RF module and said SDM, etc.

[c3] The Open Wireless Architecture (OWA) for fourth generation mobile communications of claim 1 wherein: both said wireless terminal device and said base-station further comprising:

a) A system software module to support dynamic spectrum management, spectrum sharing and resource management to increase spectrum efficiency and optimize the system performance,

b) A convergence layer module to converge wireline and wireless networks and services, as well as transmission convergence, etc,

c) A configuration management module to enable flexible system re-configuration when wireless air-interfaces change, wireline networking changes or system settings change, etc.

[c4] A system as recited in claim 1 wherein said wireless terminal device capable of system software running upon

the system hardware directly while the application software executing on the real-time OS (operating system) standards through said open wireless BIOS.

[c5] A system as recited in claim 2 wherein said open processing engine decodes, de-channelizes and demodulates the base-band channel signals and control signals of said various air-interfaces into detailed digital signaling, traffic and control information, and vice verse.

[c6] A system as recited in claim 1 wherein said base station can be reconfigured and re-programmed as wireless router, mobile soft switch or wireless gateway, etc.

[c7] A system as recited in claim 1 wherein said base station can be reconfigured to be portable and/or mobile as well for military applications or special industrial applications. In that case, the said computer system connects to the backbone networks through said broadband wireless access systems instead of said wireline networking interfaces.

[c8] A system as recited in claim 1 wherein said wireless terminal device and said base-station can communicate each other over said various different air interfaces including time-division multiple access (TDMA), code-division multiple access (CDMA), frequency-division

multiple access (FDMA) or other user-defined interfaces.

[c9] A method as recited in claim 8 detecting said various different air-interfaces for said wireless terminal device and said base-station, said method comprising:

a) performing initial channel processing from the received signals, or

b) scanning frequency carrier from the received signals, or

c) performing different decoding scheme from the received signals, or

d) performing different demodulation scheme from the received signals, or

e) running user-defined detecting technologies.

[c10] A method as recited in claim 1 connecting said transceiver system and said computer system through open software structures, comprising:

a) open operating systems supporting Windows, Linux or user-defined,

b) open resource management covering spectrum, bandwidth, channels, capacity, processors, power, storage and services, etc,

c) open communication application software enabling user-friendly programming and services,

d) common objects library and functional components defining the converged processing elements,

e) open configuration management supporting system reconfiguration in base-band parts, RF parts, antenna parts and networking parts, etc.

[c11] A system as recited in claim 2 wherein said open wireless BIOS defining the basic interface structure for the said various different air-interfaces / wireless standards (either common standards or user-defined), said standards switching, said functional modules as well as switching between internal and/or external said modules, etc.

[c12] A method as recited in claim 2 providing a smart antenna processing module for said OWA system, said method comprising:

a) using antenna arrays to process radio signals in space, not only time, to improve performance in presence of wireless fading and interference,

b) using beamforming algorithm to increase received signal-over-noise-rate (SNR) for desired directions,

c) using diversity algorithm to combat fading in order to work at less SNR,

d) using interference mitigation method to maximally reuse the channel frequencies,

e) using spatial multiplexing algorithms to increase data speeds, for example, MIMO (multiple-in and multiple-out), etc.

[c13] A system as recited in claim 2 wherein said software definable module in said wireless terminal device can be stored in or installed from said external memory card (or SIM card), or downloaded from any available networking facilities of said wireless terminal device.

[c14] A method as recited in claim 3 providing a convergence layer module for said OWA system, said method comprising:

a) open service convergence including transparent integrated services across both wireline and wireless networks, etc,

b) open transport convergence including IP (internet protocol) enterprise convergence and All-IP end-to-end convergence, etc,

c) open transmission convergence including adaptive modulation, adaptive coding and adaptive equalization, etc.

[c15] A Fourth Generation Mobile Terminal for said wireless terminal device, said terminal comprising:

a) communication / system hardware and peripherals including displayer, digital camera, sensors, smart antennas, security button, radiation detector, health detector and GPS receiver, etc,

b) software detecting available wireless networks in

the service region,

c) software configuring the detected wireless networks and installing the modules if needed,

d) software providing the information input methods for said terminal,

e) software providing enhanced security solutions for said terminal,

f) software providing connection methods for said terminal including traditional mobile networking, ad-hoc, broadcasting or user-defined topology,

g) software defining user-preferred service mode based on quality-of-service, bandwidth, traffic model, billing model, etc,

h) software providing future-proven safety solutions for said terminal,

i) software supporting next generation spectrum management methods including spectrum sharing and multiple spectrum ownership, etc,

j) software providing optimal power management solutions to minimize said terminal power consumption including base-band processing, RF, controller as well as applications, etc,

k) software supporting Voice-over-IP standard for said terminal.

[c16] A method as recited in claim 15 wherein said information

input method comprising:

a) inputting message through screen keyboard, for example, e-mails and short messages, etc,

b) converting the voice into information data through Voice Recognition system of said terminal,

c) capturing information input through short-distance wireless transmission technologies, for example, BlueTooth (BT) standard or Ultra Wide Band (UWB) standard, etc from digital camera, laptop, sensor, detector, etc,

d) inputting video from digital camera of said terminal,

e) inputting through other user-defined solutions.

[c17] A method as recited in claim 15 wherein said enhanced security solutions comprising information security, service security and transmission security, etc that the user can define the security levels by said software. Said terminal also supporting finger-print scanning and detecting, and user-defined identification technology.

[c18] A method as recited in claim 15 wherein said safety solutions comprising:

a) Health Watch providing radiation detection, monitoring and warning for said terminal; scanning of blood pressure or pulse rate; alcohol scanning, temperature scanning, etc,

b) Emergency Detection providing smoke detection, fire detection, gas detection, chemical detection, etc,

c) Emergency Response transmitting the emergency data (safety and location information, etc) automatically to emergency center, activating the said terminal emergency mode subject to either personal emergency or city-wide emergency where the whole wireless network resource will be reconfigured to support emergency communications as highest priority.

[c19] An Open Wireless Architecture (OWA) for fourth generation mobile communications said system providing a cost-effective business model and method for vendors, operators and providers of said various different wireless standards, said method comprising:

a) open spectrum management saving lots of investment in spectrum allocation,

b) open architecture saving lots of marketing costs of different standards and services,

c) open architecture saving lots of costs in infrastructure investment,

d) open architecture saving lots of costs on interoperability issues,

e) open resource management optimizing the network resource and system capacity.

[c20] A method as recited in claim 19 wherein said operators and providers share their revenues based on services sale, value chain, access infrastructure and other to-be-defined criteria of the business.